



CSOP Issues for Areas East of Everglades National Park

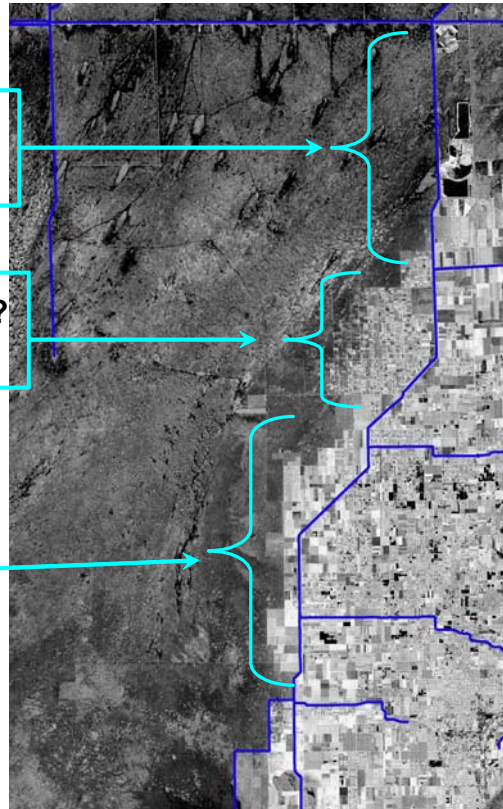
- **The impact of past and current operations**
- **Implications for CSOP**

A presentation to the
CSOP Advisory Team
March 8, 2004

**Can Seepage from Northeast Shark
River Slough Be Controlled ?**

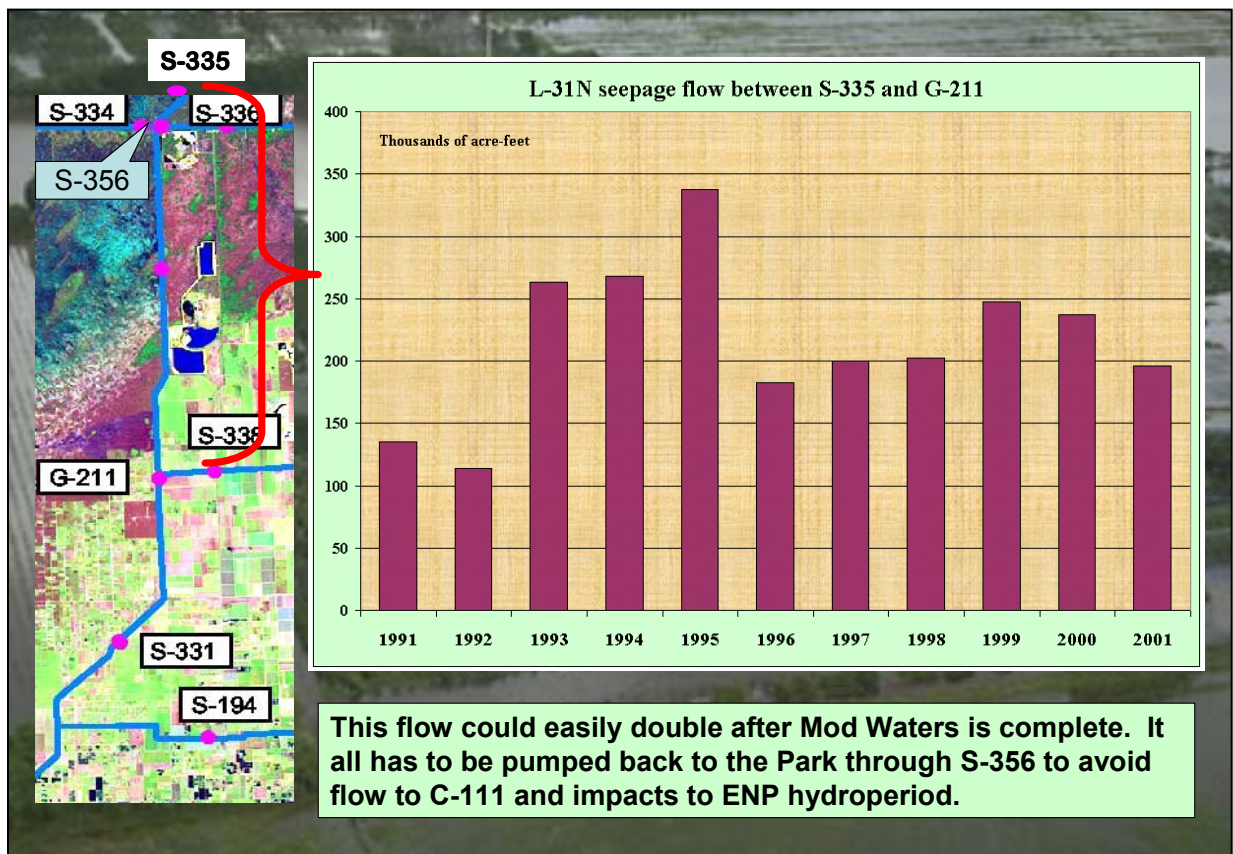
**What does 'Flood Mitigation' mean ?
How much water will flow south ?**

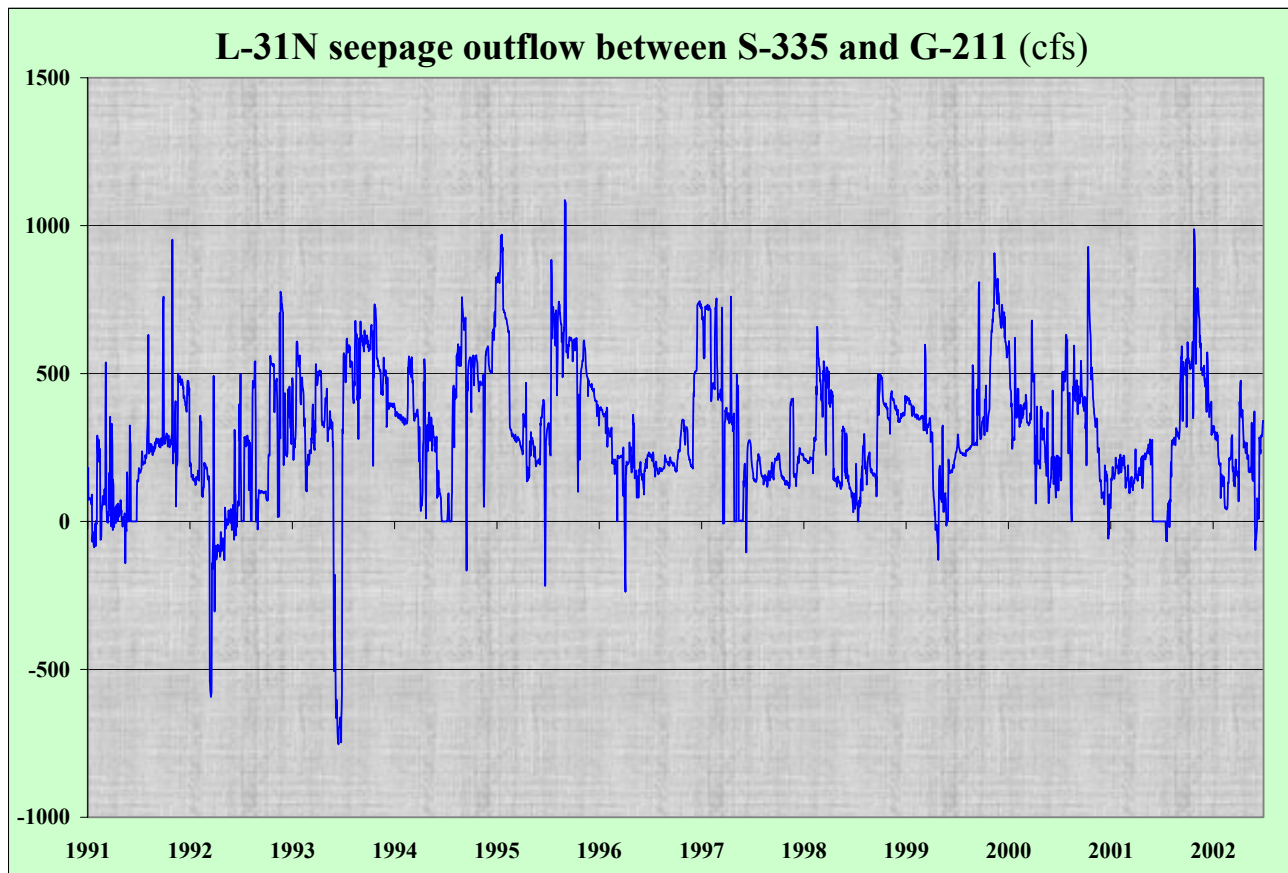
**Will the Buffer Cells work
without overflow ?
Is the C-111 Plan compatible
with the 8.5 SMA Plan ?**



Seepage from ENP into the Northern Reach of L-31N

- Will the plan in the Modified Water Delivery Project be sufficient ?
- Is the goal to re-capture more of the seepage from the Park or only to preserve the status quo ?

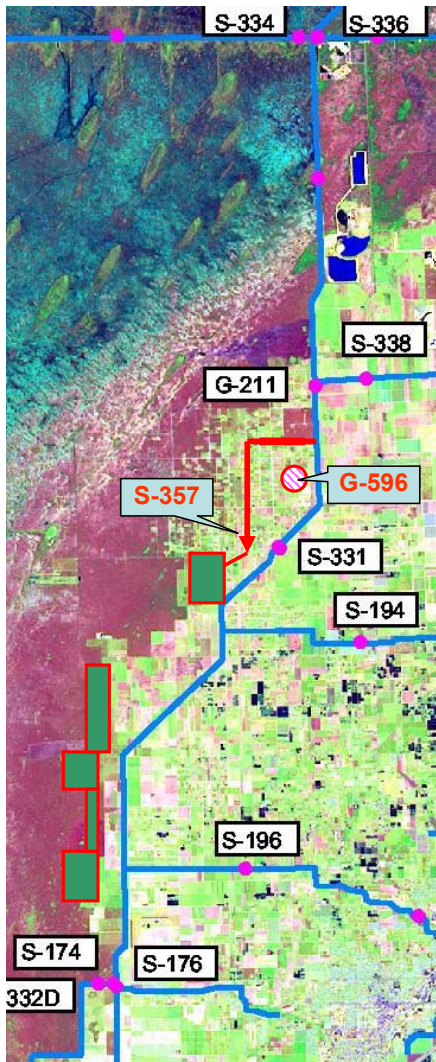




A canal water budget was developed for the reach between G-211 and S-335 to determine how much seepage has been removed from this canal section since G-211 was completed in 1990.

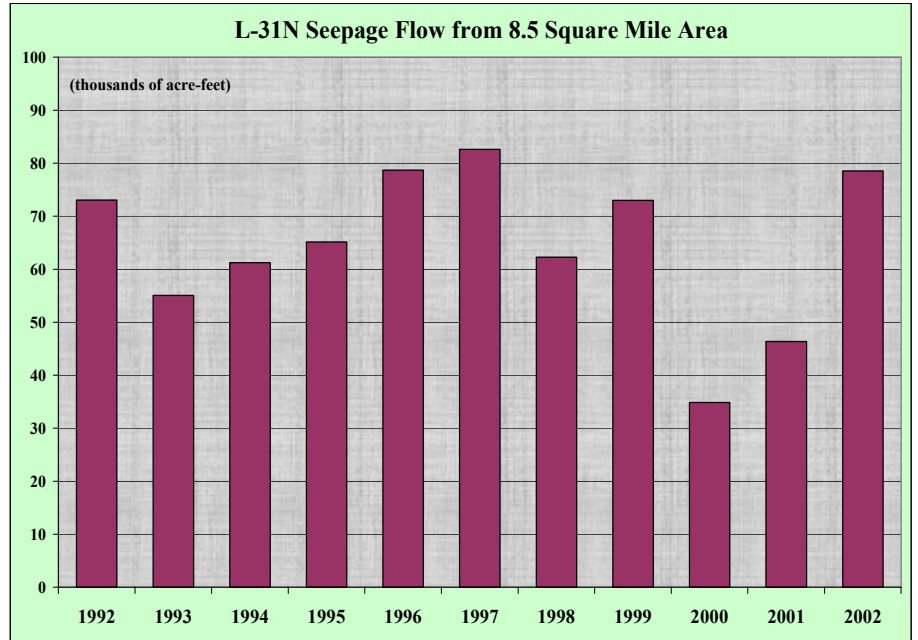
This is a useful exercise since the operating rules for G-211 are the same as proposed for the S-356 pump station that is part of the Mod Waters Project. The design capacity for S-356 is 500 cubic feet per second. Observed flow rates since 1993 are above that value almost 20% of the time, sometime for extended periods of time.

Based on actual field data collected over the last ten years it is clear that S-356 will have to have a capacity much greater than the current plan. Once flow is restored to NESRS seepage collected by this reach of the canal can be expected to double due to the much higher water levels that will occur in the eastern section of the Park. CSOP must look at resizing S-356 to accommodate the expected flow.



8.5 SMA Technical Details

- How do you define “Flood Mitigation” ?
- How much water will have to be diverted south through the new pump station ?
- Will the Flow at S-357 seep to the L-31N canal ?
- Will S-331 still be used to pass wet season flow to the south ?



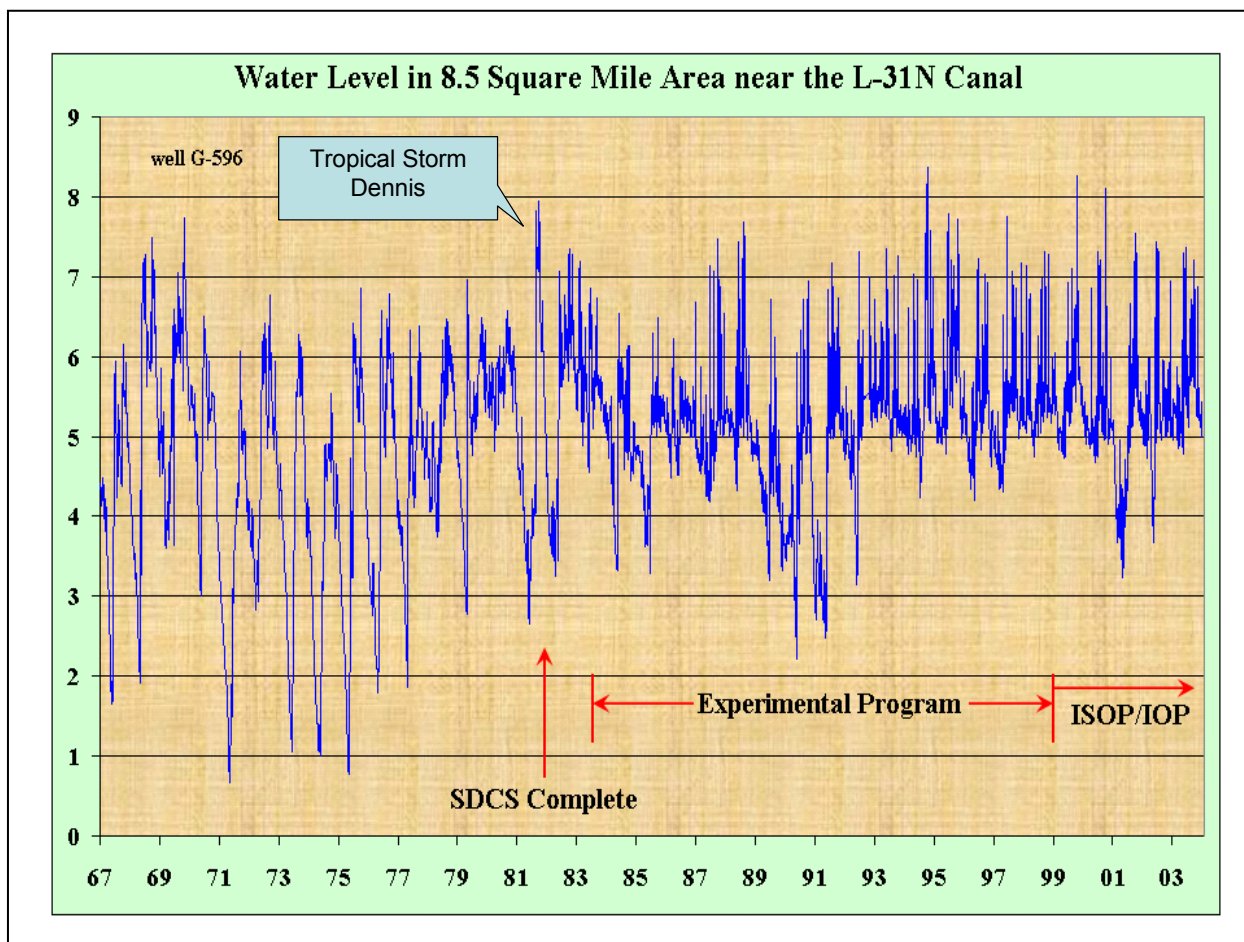
Design questions for the 8.5 SMA

A canal water budget was calculated for the section of the L-31N canal adjacent to the 8.5 SMA to determine how much seepage has been removed from the 8.5 SMA by the canal since 1993.

The data show between 50 and 85 thousand acre-feet per year during normal to wet years. With the increased water levels that will result when Mod Waters is complete, much more flow than this will be pumped by S-357.

The question for CSOP is how much of that flow will seep into the L-31N canal and become part of the new big (?) red arrow, and will the assumptions made in designing the C-111 GRR still hold.

The concept of no flow toward the Park from the C-111 buffer cells was not on the table when Alternative 6D was chosen as the solution for the 8.5 SMA or when the C-111 GRR was approved.

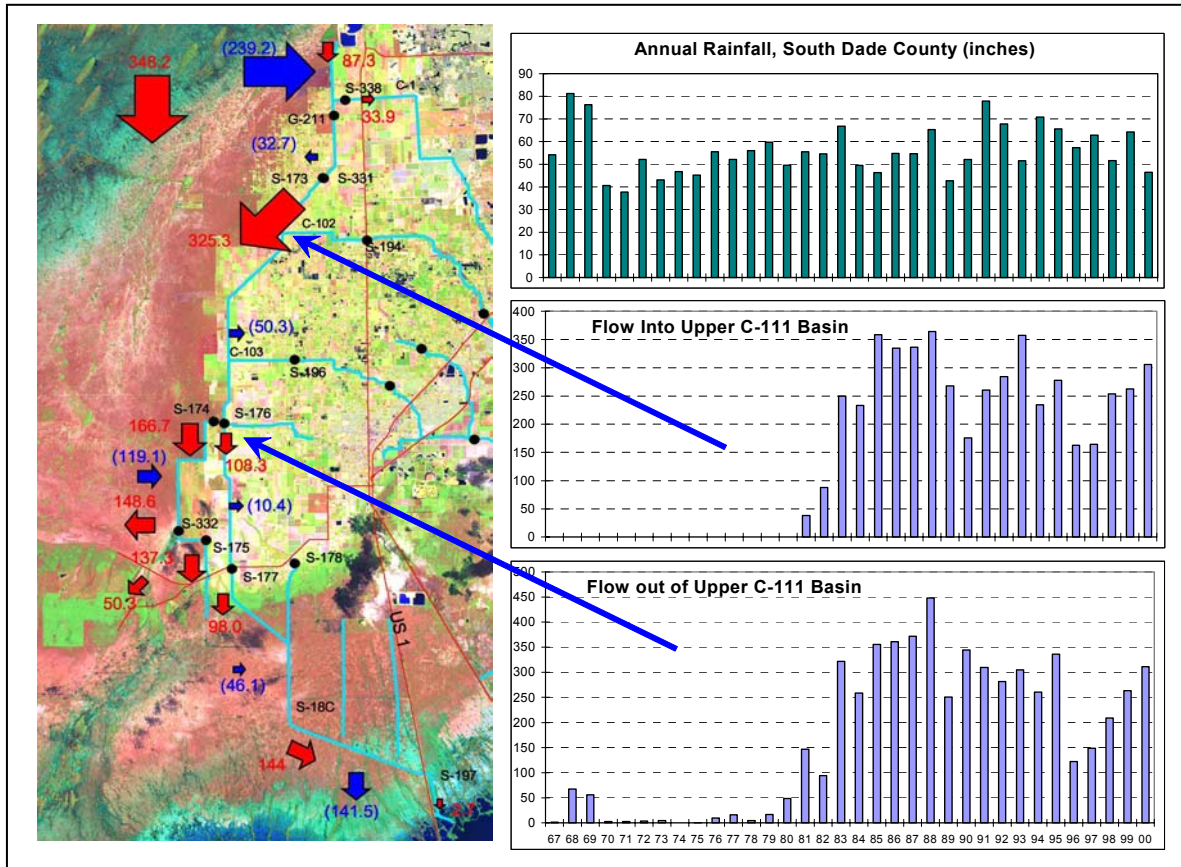


This is a plot of the daily water level at the G-596 well since the construction of the south Dade canal system. This well is located just west of the L-31N canal and represents the best case for water conditions in the residential area (i.e. being near the canal it has the best drainage).

The theory of the experimental program and ISOP and IOP has been that pumping S-331 to lower that small reach of the canal would offset higher water levels caused by re-flooding Northeast Shark River Slough. This has clearly not been the case. The various operational schemes, especially since 1993 have clearly contributed to the flooding in the area. The sustained high water levels have contributed to the damage to the local roads and frustrated landowner attempts to make improvements.

This chart shows how difficult the concept of flood mitigation is to define in terms specific enough to use as a design basis for the water management system. The seepage data on the previous chart was computed for the 1993-2002 period and represents much less than should have been removed to prevent impacts in the residential area.

SOUTHERN L-31N : NORTHERN TAYLOR SLOUGH AND AGRICULTURAL FLOOD PROTECTION



The figure on the left is a water budget slide for the year 1993 taken from the SFWMD report on the C-111 Interim Plan.

The bar charts depict annual rainfall and flow from 1967 through 2002, which covers the period after completion of the original canal system in south Dade.

The data show the dominating impact of the South Dade Conveyance System (SDCS) on the surface hydrology of the C-111 basin. Prior to the completion of the SDCS, S.W. 168th St. (where S-173 is located) marked the northern boundary of the C-111 basin. There was no flow into the basin from north of this point prior to construction of the SDCS.

The SDCS was constructed between roughly 1978 and 1982, with the activation of the S-331 Pump Station in February 1983 marking the start of operations. The experimental water delivery program began with a 30-day test in March 1983 with the flow-through experiment beginning in June 1983 and lasting through June 1985. The Fascell Bill to formally authorize the experimental delivery program was passed in 1984.

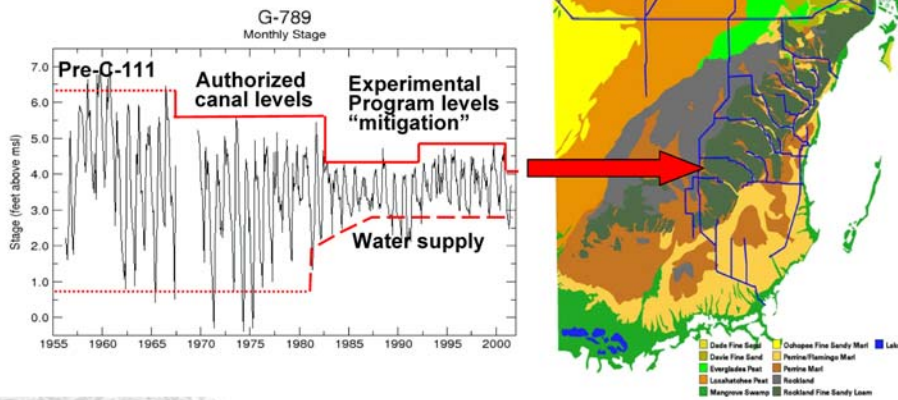


Changes in Water Levels Taylor Slough Basin

EXPERIENCE
YOUR
AMERICA

The lowered canal operational levels have drained the eastern transitional marshes in Taylor Slough.

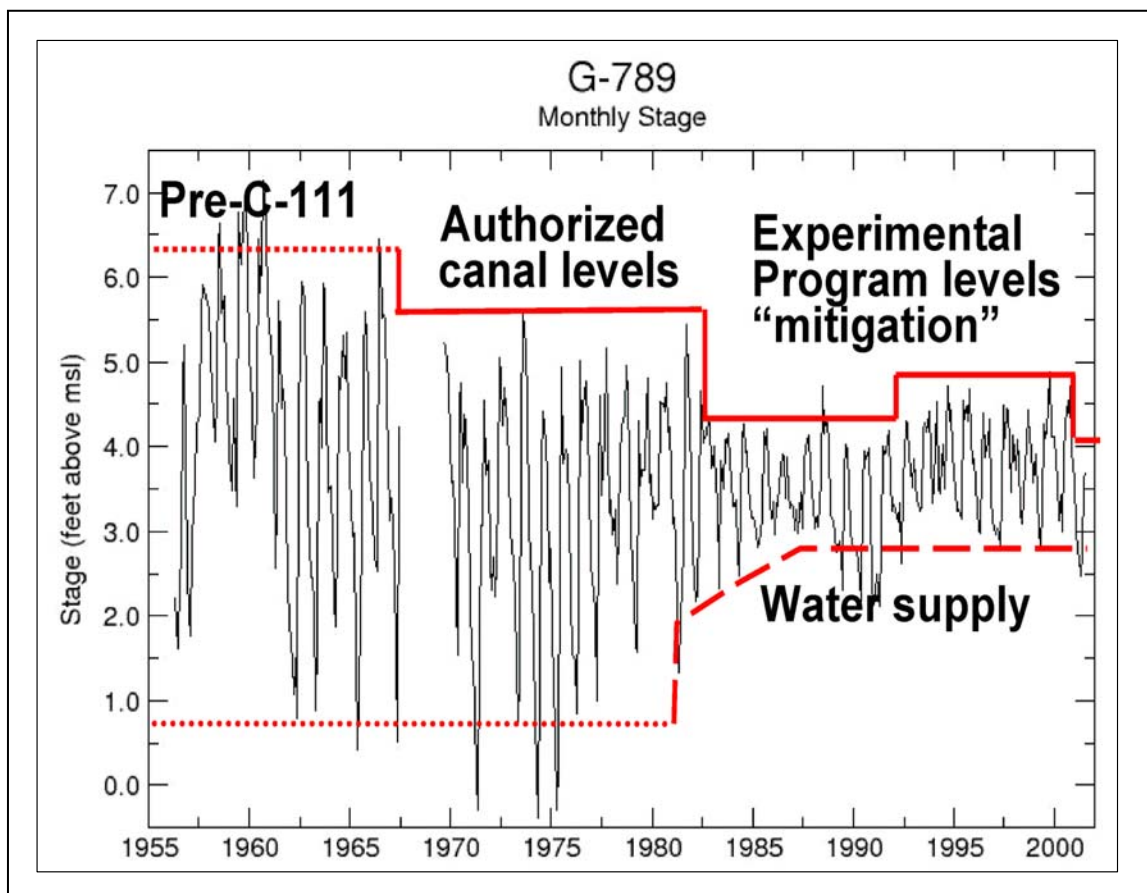
This wetland drainage has diminished the aquatic communities and modified vegetation patterns.



This slide is used often by Everglades National Park staff in describing the 'drainage' of marshes in Taylor Slough. G-789 is a groundwater monitoring location maintained by the USGS just east of the L-31N Canal near the Homestead General Aviation Airport. The water level in the well is clearly influenced by operations in the canal.

The water level shown here is the monthly average level and is not useful for showing flooding impacts. The record at this site does NOT support the Park staff's conclusion that lowered operational levels here have drained the marshes in Taylor Slough.

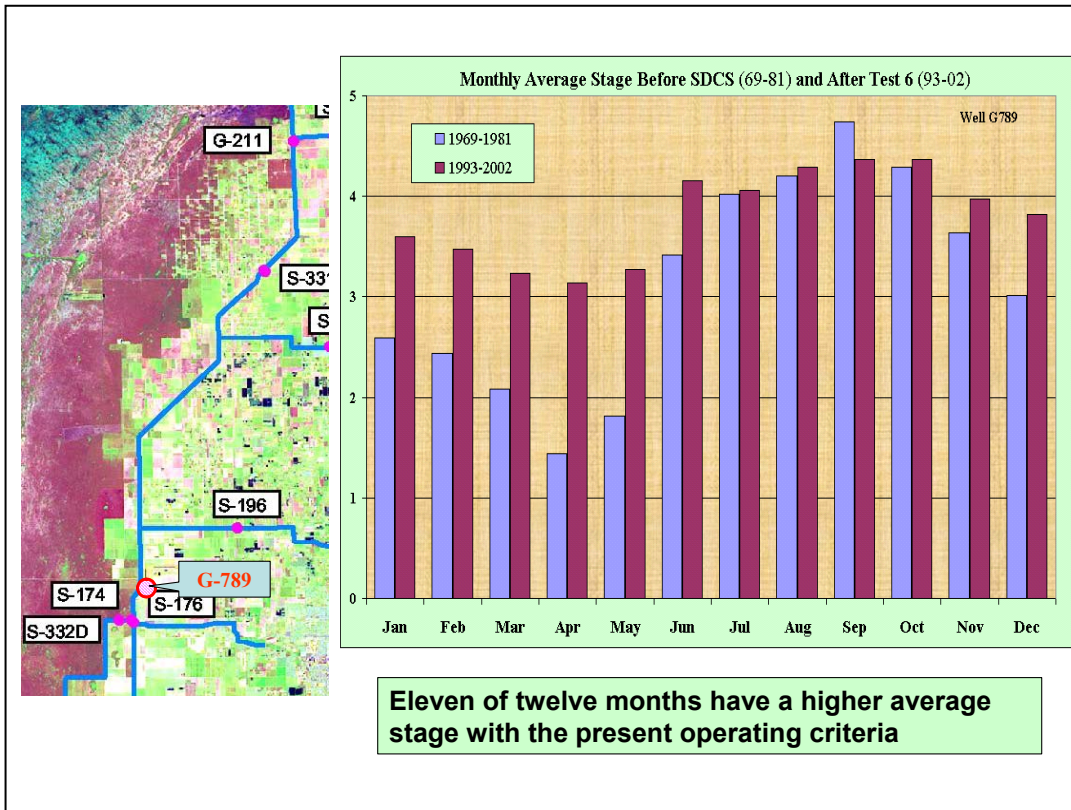
If you ignore the red lines and just look at the actual data there appears to be a slight reduction in the peak average monthly stage and a much larger increase in the average stage in other months.



The solid red line above the data does not reflect “authorized canal levels” but rather the gate opening criteria for structures S-174 and S-176 which are located at the southern end of the L-31N canal near well G-789. The Corps does not “authorize” canal levels, they build authorized structures and operate them to achieve the authorized purposes. In this case the structures were built to allow overflow at elevation 5.0 and the gates were set to open when the canal level rose to 5.5 despite the overflow. A canal stage of 5.0 was just as “authorized” as a stage of 5.5, and from the record it is obvious that stages below 5.0 were much more common than stages above 5.0 after the canal system was built.

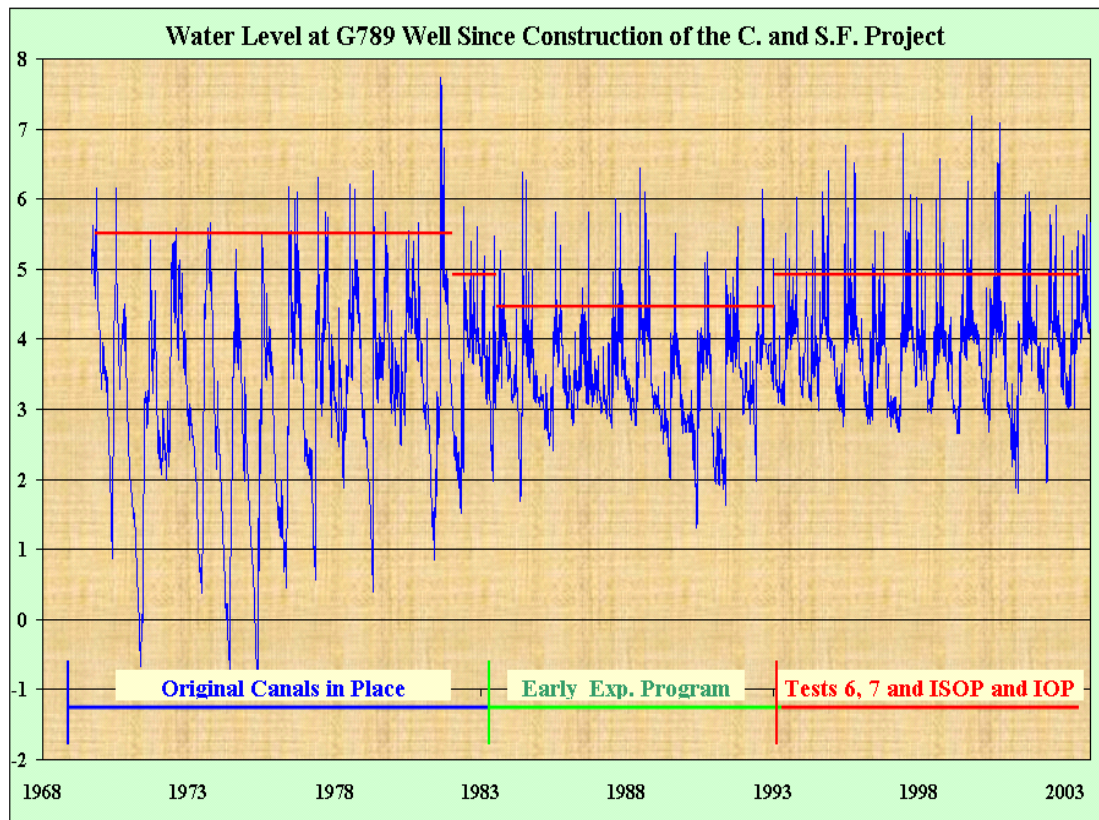
The first phase of the experimental program set operating levels at about 4.5. At that time there was no experience with the SDCS and the G-211 structure to reduce seepage flow out of ENP had not been constructed. There was also farming on both sides of the L-31N canal and importing water into the basin without lowering the operating criteria would have caused flooding.

With the beginning of Test 6 the operating levels were raised back to 5.0, even though large diversions of flow to south Dade continued.



This is another way to display average monthly data. The chart compares the average levels by month for the period prior to the completion of the SDCS with the levels observed since 1993. The data show that for every month except September the average stage for the current period has been higher.

The four inch reduction for that one month is more than offset by the average nine inch increase for the other eleven months. The net result is a decrease in seepage out of Northern Taylor Slough because of the persistently higher water table to the east as indicated by the data at this site, and a concurrent reduction of the drainage of the marshes in Taylor Slough.



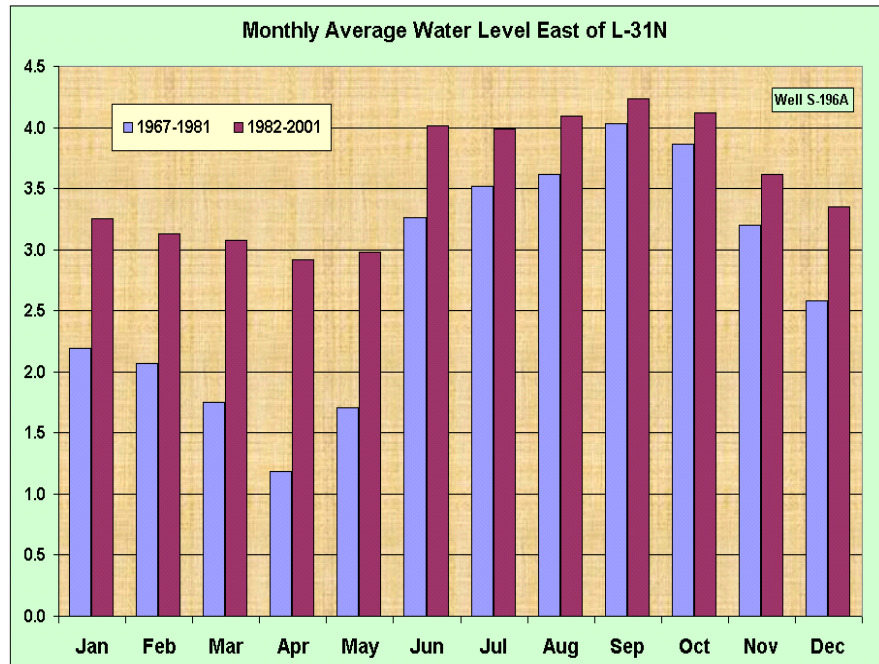
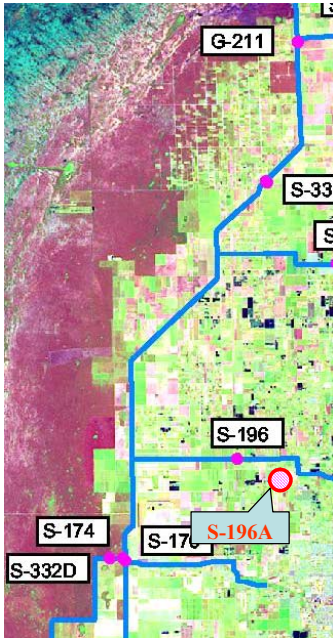
This is the actual daily data collected at the same G-789 well after construction of the original canal system, with the gate opening criteria shown in red, similar to the ENP slide.

It should be noted that the first change in the gate opening criteria came in response to Tropical Storm Dennis in 1981, not the experimental program.

A temporary reduction in the average water level is noticeable in the early experimental program but the peak stages are similar to those experienced earlier.

The most obvious change to the hydrology is the dramatic increase in the average water table. For the past ten years, coinciding with Tests 6 and 7 of the Experimental Program and the ISOP and IOP actions, the frequency of damaging high stages has increased while low stages, even in severe droughts, are several feet higher than the low water levels that occurred routinely in the past.

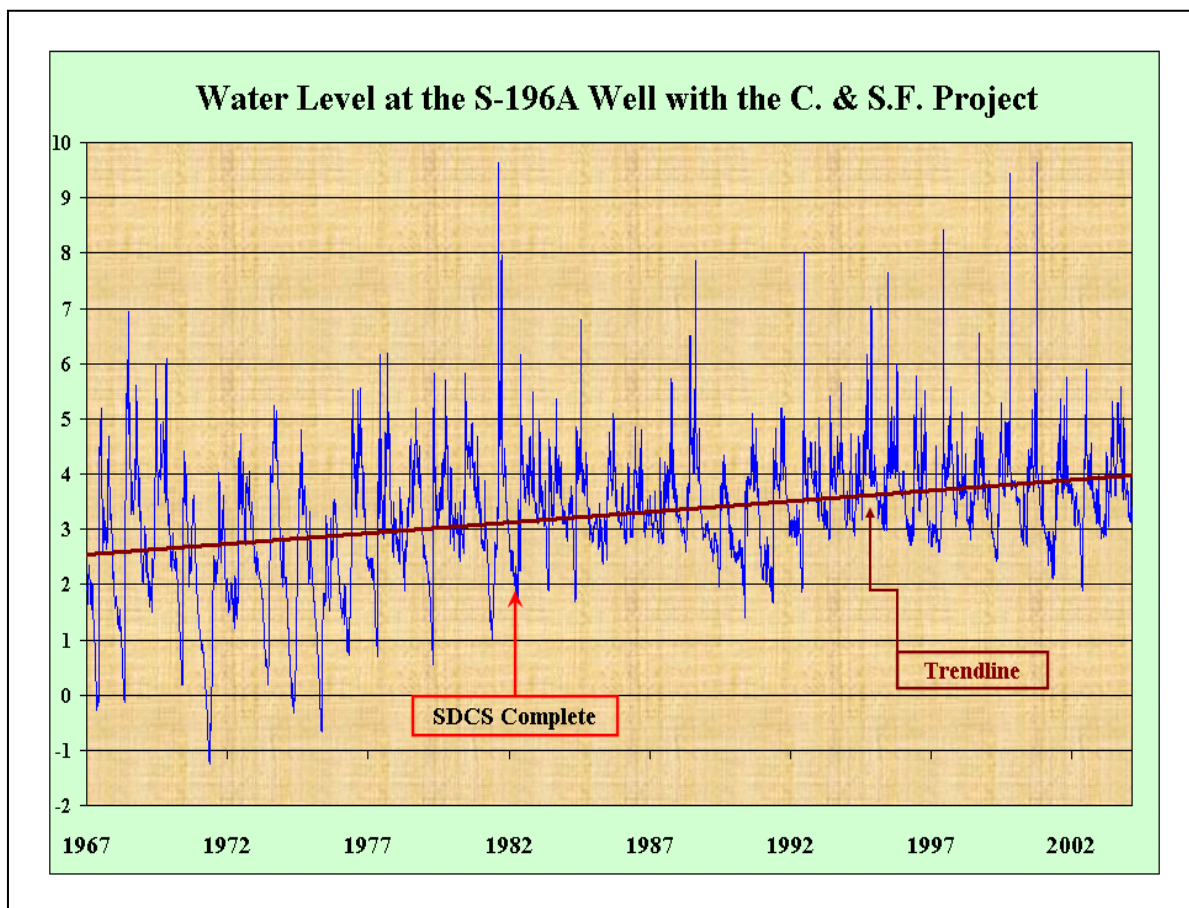
The data clearly show that the changes to canal operations, taken as a whole, have significantly increased, not decreased, the water table, and that drainage of ENP marshes has been reduced, not increased.



Even the eastern edge of the agricultural area has been affected.
Every month has a higher average stage with the present operating criteria

This is the same display for a groundwater monitoring site (S-196A) about 5 miles east of the L-31N canal. Being further from the canal it does not benefit from the drainage provided by the C-111 canal during high stages as does the location of G-789.

The average monthly stage for this site is higher every month compared to the period before the SDCS and the experimental delivery program. This is a direct result of the water being imported into the basin at S-331, and has been a contributing factor to the significant agricultural crop damage over the last ten years.



This is a plot of the daily stage at well S-196A, 5 miles east of L-31N. It is obvious that for the period since 1993, when the operating level at S-176 was raised, the water table is significantly higher and the frequency of flooding has increased. This gage is well east of the L-31N canal and the data collected here is indicative of the high water problem that has plagued south Dade agriculture since the SDCS was completed and the experimental program began.

The trendline indicates a steadily increase in the average water table position although the actual experience indicates a step change increase associated with the raising of the S-176 and S-174 operating levels in 1993.

CONCLUSIONS

North of G-211

- Based upon a review of actual data the proposed S-356 pump station is too small.
- Proper Sequencing of Project Components is Critical. Removing the L-67 extension levee and connecting WCA-3A and 3B can only happen after:
 - Tamiami Trail is reconstructed,
 - An adequately sized S-356 is in operation,
 - The 8.5 SMA protection plan is in place, and
 - The C-111 project is in place and shown to be capable of managing the local needs and the new water from the 8.5 SMA.

8.5 Square Mile Area

- The Level of Service for water management to be provided for the residential area has to be defined with numbers, not words.
- Reliable estimates of downstream impacts must be provided.

C-111 basin

- The concept of “Marsh Triggers” for operation of the buffer cells is not compatible with the C-111 GRR Plan, the 8.5 SMA design, or the CERP.
- Large quantities of northern water will still be coming south, so operation of the canal system and the buffer cells must be appropriate to avoid continuing, or worsening, existing flooding problems.